INSTRUCTION MANUAL

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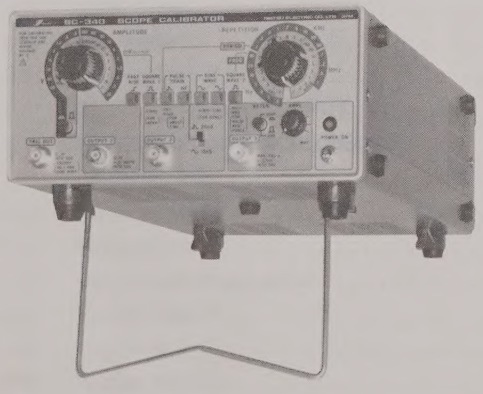

INSTRUCTION MANUAL

SCOPE CALIBRATOR

SC-340

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Section 1

Specifications

1-1 OUTLINE

The scope calibrator SC-340 is a portable signal generator used to calibrate a oscilloscope. It can check the specifications of a vertical deflection circuit such as:

- Deflection factor
- Attenuator phase
- The leading edge of the square wave
- Other pulse response

and those of a horizontal deflection circuit such as:

- Sweep time
- Trigger circuit condition

The features are:

- One SC-340 is enough for main adjustment of a oscilloscope. Thus, high specifications of the oscilloscope can always be assured.
- An output waveform can be extracted in one press of the pushbutton switch. This means high operability of the SC-340.
- The SC-340 is equipped with a TRIG OUT. Therefore, even when trigger is unstable during high-speed sweep, the output waveform can be checked easily.

The SC-340 can adjust the following main specifications:

1. Vertical deflection factor and phase (Minimum output voltage: 0.12 mV, maximum output voltage: 100V, 1-kHz square wave)
2. Leading edge of square wave (Rise time: 300 ps or less.)
3. Pulse response (Flat square wave output with little distortion)
4. Sweep time (High-accuracy adjustment by the high stable crystal oscillator)
5. Triggering (Sine wave, power frequency, and 1-kHz checks are possible.)

1-2 COMPONENTS

The SC-340 consists of a mainframe and accessories.

Mainframe 1

Accessories

Slow blow fuse (0.5A) 2

Accessory bag 1

Instruction manual 1

1-3 ELECTRICAL SPECIFICATIONS

1-3-1 Square Wave 1

Waveform	Square wave
Repetition Rate	1 kHz, Accuracy: ± 20%
Output Voltage	0.12mV to 60V in 18 steps in a 1.2-3-6 sequence. 0.2 mV to 100 V in 18 steps in a 1-2-5 sequence Accuracy: ± 0.5% (at 1 MΩ load)
Rise Time	5 μs or less
Distortion	Overshoot: 10% or less Rounding: 10% or less Sag: 0.5%
Slope	Positive
Duty Ratio	40:60 or less
Output Resistance	50Ω (in ranges lower than 200 mV) (In ranges higher than 300mV, the output resistance differs in each range.) In ranges lower than ⚠ 200 mV, the output voltage is half the specified value when a 50Ω terminator is connected.

1-3-2 Fast Rise

Waveform	Oscillation waveform of tunnel diode
Repetition Rate	100 kHz (10 kHz to 200 kHz)
Output Voltage	0.1 V or more (at 50Ω load)
Rise Time	300 ps or less (at 50Ω load)
Distortion	Overshoot 3% or less Other distortion: 3% or less (when using a 100 MHz bandwidth oscilloscope.)
Slope	Positive
Output Resistance	50Ω

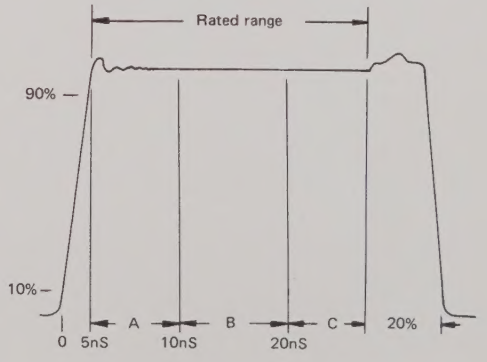
1-3-3 Square Wave 2

Waveform	Square waveform
Repetition Rate	0.5 Hz to 1 MHz in 20 steps in a 1-2-5 sequence. Accuracy: ± 0.05%
Output Voltage	0.5 V or more (at 50Ω load) (approximately 50 mV to 1.3 V with ATTEN and AMPL) ATTEN 20 dB accuracy ± 15% Continuously variable with AMPL 8dB (± 20%)
Rise Time	5 ns or less
Distortion	A: 5 ns to 10 ns 5% B: 10 ns to 20 ns Typical 1%, maximum 1.5% C: 20 ns or greater Typical 0.5%. maximum 1% Distortion refers to overshoot, ringing, rounding, and sag
Rated Range	See Figure 1-3-3.
Polarity	Positive only in guaranteed.
Duty Ratio	1, 2 step 60:40 or less 5 step 70:30 or less
Output Resistance	50Ω

1-3-4 Pulse Train ⊥

Waveform	Differentiated wave
Repetition Interval	0.1 μs to 2 s in 23 steps in a 1-2-5 sequence Accuracy: ± 0.05%
Output Voltage	0.1V or more (at 50Ω load)
Polarity	Positive

Figure 1-3-3 Square Wave 2



1-3-5 Pulse Train HF

Waveform	Sine wave or square wave (switched)
Repetition Interval	10 ns (sine wave), 20 ns (square wave) Accuracy: ± 0.05%
Output Voltage	0.2V or more (at 50Ω load)

1-3-6 Sine Wave

Waveform	Sine wave
Repetition Rate	1 kHz ± 20% or line frequency (switched)
Output Voltage	0.2 Vp-p or more

1-3-7 Trig Out

Trigger Signal	Signals shown in Table 1-3-7 are provided according to selection of signal outputs.

1-3-8 Power Supply

Line Voltage	AC 117V ± 10% (Optionally, the following three voltages are available through rewiring of power transformer.)

Table 1-3-8

Median Voltage	Voltage Range
AC 100V	90V to 110V
AC 217V	196V to 238V
AC 238V	122V to 257V

Line Frequency	50 to 400 Hz
Power Consumption	Approximately 15W

1-3-9 Warm-up Time

Warm-up Time	15 minutes or more

Table 1-3-7

Waveform Selection Switch	Trigger Signal	Output Voltage	Time Difference Between Trigger and Signal Outputs	Signal Repetition Rate
SQUARE WAVE 1	–	–	–	–
FAST RISE	Same as signal output	0.1V or more		100 kHz (10 kHz to 200 kHz)
SQUARE WAVE 2	Differential wave	0.2V or more	50 ns or less	100 kHz
PULSE TRAIN ⊥	Differential wave	0.2V or more	–	Same as signal output
PULSE TRAIN HF	Sine or square wave	0.2V or more	50 ns or less	2.5 MHz
SINE WAVE	–	–	–	–

1-4 PHYSICAL SPECIFICATIONS

1-4-1 Weight
Approximately 3.5 kg

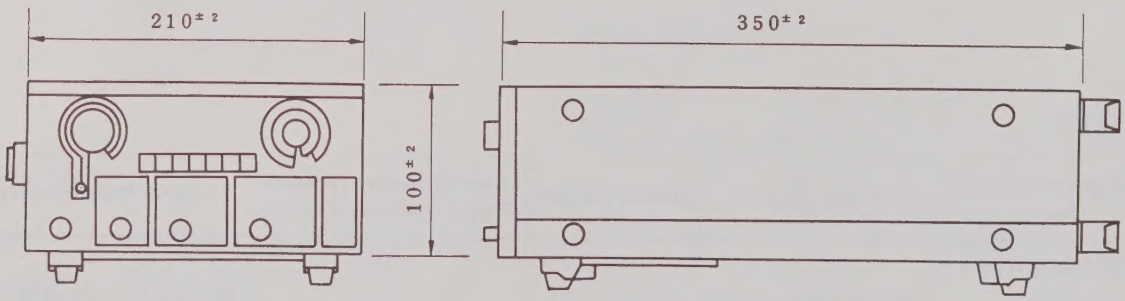
1-4-2 Dimensions
(210 ± 2)W x (100 ± 2)H x (350 ± ± 2) L mm

1-5 ENVIRONMENTAL CONDITION

Operating Temperature 0°C to +50°C
Accuracy Guarantee Temperature
+10°C to +35°C

Operating Humidity	80% RH or less at 40°C
Storage Temperature	−20°C to +70°C
Storage Humidity	80% RH or less at 70°C
Altitude	Operation: 5,000m maximum (barometric pressure: 405 hPa Non-operating: 15,000m maximum (barometric pressure 90.4 hPa
Vibration Test	Vibrate for 30 minutes along each axis at a total displacement of 1mm with the frequency varied from 10 to 35 Hz.
Shock Test	Raise one end 5cm (maximum angle: 30°) and drop on hard wooden surface. Perform for each side.
Drop Test	Pack for transportation and drop from a height of 75cm.

Figure 1-4-2 Dimensions



Section 2

Operating Information

2-1 PRECAUTIONS

Check Line Voltage

The allowed line voltages are from AC 106 to 128V. Using line voltage outside this range may result in malfunction. (See table 1-3-8 for optional line voltage.)

⏚ Ground

Be sure to ground the ground terminal for safety.

Check Ambient Temperature and Humidity

Normal operation of this instrument is guaranteed in the following ambient condition; 0°C to +50°C operating temperature, +10°C to +35°C accuracy guaranteed temperature and less than 80% (at +40°C) relative humidity. Operation in this range is essential.

Do not place any object on top of the ventilation opening on the cover.

Warm-up

This instrument is guaranteed to operate normally 15 minutes after power on.

Fuse

This instrument is equipped with 0.5A slow blow fuse (rear side fuse holder) on the primary side of power supply to prevent circuit damage due to over-current. If this fuse blows out, check the cause carefully, repair if necessary, and then replace with specified fuse. Never use fuse other than specified.

Signal Output Terminal and Signal Input

Be careful not to short-circuit signal output terminal to ground because this may cause over-current and damage the circuit. Also, be careful not to input high input voltage.

Wave Selection Switch

The wave selection switch is used to select signal output from the OUTPUT connector. Be careful of the following:

If all wave selection switches are pressed, fast rise signal is output from OUTPUT 1 and square wave 1 signal is output from OUTPUT 2.

If none of the switches is pressed, no signal is output.

Stand

A bail-type stand is mounted on the bottom cover. This stand permits the SC-430 to be positioned for convenient operation. The instrument may also be set on the rear or right feet either for operation or storage.

2-2 CONTROLS AND SWITCHES

This section describes the functions and usage of switches adjustments, and connectors on the front and rear panels.

2-2-1 Front Panel

POWER ON

Power on switch. Power is supplied to the instrument when this switch is turned on and the pilot light glows.

FAST RISE ⎍

Push button switch to provide a fast rise pulse (10kHz to 200kHz) of 300 ps rise time and 100 kHz repetition rate. This pulse is used for calibration of rise portion of square waves.

OUTPUT 1

Output connector for the fast rise pulse.

SQUARE WAVE 1 ⎍

Push button switch to provide a square wave with repetition rate of 1 kHz ± 20%. This square wave is used for calibration of deflection factor (sensitivity) and attenuator compensation.

AMPLITUDE

Switch for selection of square wave output voltage. It is effective only when SQUARE WAVE is pressed. The output voltage is changed as follows with the push button switch located below AMPLITUDE:

When (⎍) : From 0.12mV to 60V in 1.2-3-6 steps.
When (⎍) : From 0.2mV to 100V in 1-2-5 steps.

PULSE TRAIN ⎍

Push button switch to output differential wave. This is used to calibrate sweep time between 0.1 μs and 2 s.

REPETITION

Switch for selecting repetition interval or repetition rate. This switch is effective only when PULSE TRAIN ⎍, or SQUARE WAVE 2 is pressed.

PERIOD: Change repetition interval between 0.1 μs and 2 s in 23 steps in 1-2-5 sequence.

FREQ: Change repetition rate between 0.5 Hz and 1 MHz in 20 steps in 1-2-5 sequence. The 3 steps beyond 1 MHz do not output any signal.

PULSE TRAIN HF

Push button switch to output square wave or sine wave. This is used to calibrate high-speed sweep time between 10 nS and 20 nS.

10 nS/20 nS

Slide switch for selecting 10 nS sine wave or 20 nS square wave. This switch is effective only when PULSE TRAIN HF is pressed.

SINE WAVE ~

Push button switch to output line frequency and approximately 1 kHz sine wave. It is used to calibrate the trigger circuit.

OUTPUT 2

Output connector for the following waveforms:
SQUARE WAVE 1, PULSE TRAIN, SINE WAVE

SQUARE WAVE 2 ⎍

Push button switch to output square wave between 0.5 Hz and 1 MHz. It is used to calibrate pulse response.

ATTEN

Push button switch for selecting the attenuation amplitude of square wave. It is effective only when SQUARE WAVE 2 is pressed.

When (⎍) : Attenuation amplitude is 0 dB (0).
When (⎍) : Attenuation amplitude is 20 dB (1/10).

Figure 2-2-1. Front panel

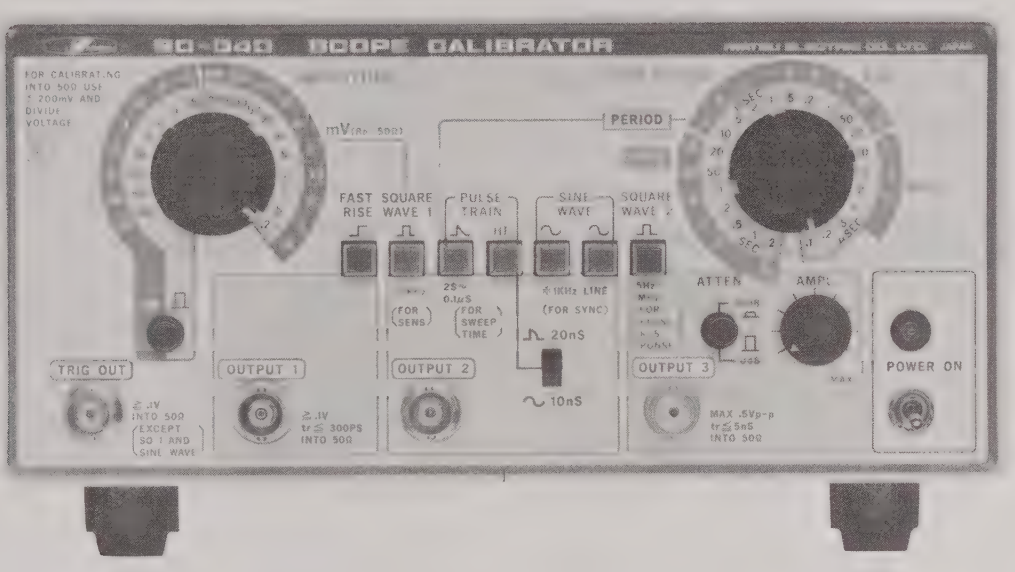


Figure 2-2-2. Rear panel

AMPL

Variable control for adjusting the amplitude of square wave. It is effective only when SQUARE WAVE 2 is pressed.

OUTPUT 3

Output connector for square wave 2.

TRIG OUT

Output connector for trigger signal. Trigger signal is not output when square wave 1 or sine wave is output.

2-2-2 Rear Panel

FUSE

Fuse holder for primary power supply. It contains a 0.5A slow blow fuse.

Refer to table 1-3-8 when using power supply other than AC 117V.

Ground terminal.

2-3 GENERAL OPERATING INFORMATION

2-3-1 Function Switch

The function switch of the SC-340 is composed of self-canceling pushbuttons from the FAST RISE to the SQUARE WAVE 2. The switch permits selection of a signal output required for check and adjustment of oscilloscopes.

2-3-2 Fast Rise Pulse

The fast rise pulse can be used for check and adjustment of pulse response and rise time of wide bandwidth oscilloscopes (100 MHz or less).

Minimum rise time and optimum pulse characteristics can be obtained only if a 50Ω BNC cable is used for connection of the signal output and the output is terminated in 50Ω. A special in-line termination (BB-50M1) and 50Ω BNC cable of 500 mm length (BB-500) are supplied with the SC-340 for this purpose.

2-3-3 Square Wave 1

The square wave 1 signal can be used for check and calibration of deflection factor (sensitivity) and attenuator compensation.

Output voltages shown by the AMPLITUDE switch can be obtained with no termination of the output. Notice that the voltage is divided 1/2 times in the ranges higher than 0.3V if the output is terminated in 50Ω.

2-3-4 Pulse Train

The pulse train (time marker) can be used for check and calibration of sweep rate (sweep time).

The repetition interval can be selected from 2 s to 10 ns by the REPETITION and 20 nS–10 nS switches.

Terminating the output with the 50Ω terminator allows optimum marker definition and consistent marker amplitude.

When 10 ns or 20 ns marker is used, utilizing the trigger output as the trigger signal for an oscilloscope permits its stable triggering.

2-3-5 Sine Wave

The sine wave can be used for check and calibration of triggering.

2-3-6 Square Wave 2

The square wave signal 2 can be used for check and calibration of pulse response and rise time of oscilloscopes less than 50MHz bandwidth.

Connect and terminate the output with the accessory BNC cable and 50Ω terminator to obtain minimum rise time and optimum pulse response.

2-3-7 Trigger Output

Trigger signal is output from TRIG OUT connector. Trigger signal is output when either FAST RISE, SQUARE WAVE 2, or PULSE TRAIN waveform selection switch is pressed. This trigger signal is used as external synchronization signal when calibrating sine wave or sweep time.

2-4 ADJUSTMENT OF OSCILLOSCOPE

For an oscilloscope to give accurate measurement, each circuit must operate properly. The SC-340 can be used to periodically check and calibrate the oscilloscope to increase reliability, specification, and availability.

This section describes the adjustment method. Use this method when the accuracy of the oscilloscope is outside the specified accuracy. Adjustment is not necessary when the accuracy is within specification.

〈 **Note** 〉

Adjustment method for oscilloscope differ from model to model. Be sure to read the operating instruction of the oscilloscope ("Section 4 Check and Adjustment") before check and adjustment.

Note that there is a restriction on the frequency range of the oscilloscope that can be calibrated with this instrument. It must be 100 MHz or less when calibrating fast rise wave distortion and 50 MHz or less when calibrating square wave 2 wave distortion (rise only). Other waves can be calibrated outside this range.

2-4-1 Warming up

For accurate check, allow the SC-340 and the oscilloscope to warmup for 15 minutes or more and the assigned time respectively.

2-4-2 Accessories

(1)	BNC coaxial calbe	2
	Length	Approximately 500 mm
		〈Example〉 Iwatsu BB-500
(2)	10:1 passive probe	1
	Length	Approximately 1m
		Probe matching the oscilloscope
(3)	50Ω terminator	2
		〈Example〉 Iwatsu BB-50M1
(4)	Connection cable	1
	Length	〈Example〉 Iwatsu 420 connection cable B (black)

(5) Adjustment screw driver for probe adjustment

2-4-3 Adjustment Preparation

Setting controls

(1) Set the oscilloscope controls as follows:

POWER	ON
SCAL ILLUM	Fully clockwise
INTENSITY	Appropriate brightness
FOCUS	Appropriate focus
MODE	CH1
AC-GND-DC	DC
VOLTS/DIV (CH1, CH2)	5 mV
VARIABLE (CH1, CH2)	CAL
POSITION (CH1, CH2)	Center
HORIZ DISPLAY	A
SOURCE	INT
SWEEP MODE	AUTO
COUPLING	AC
SLOPE	+
A TIME/DIV	0.5m SEC
B TIME/DIV	0.1m SEC
A VARIABLE	CAL
POSITION	Center
LEVEL	Center
B MODE	AUTO

(2) Set the controls on SC-340 as follows:

POWER	On
Wave selection	(⊓⊔)
AMPLITUDE	.12 mV (⊓⊔)
REPETITION	1 kHz
ATTEN	20 dB
AMPL	Fully counter clockwise
10 nS/20 nS	20 nS

2-4-4 Square Wave 1

The following describes the method for calibrating accuracy of deflection factor and attenuator phase.

Deflection factor adjustment

(1) Connect CH1 INPUT of oscilloscope to OUTPUT 2 connector of SC-340 with a coaxial cable.
(2) Set the wave selection to SQUARE WAVE 1 and AMPLITUDE to 30 mV on the SC-340.
(3) Check that a 1 kHz square wave is displayed. (See Figure 2-4-4-(1)).
(4) Adjust amplitude on display to 6 div.
(5) Change CH1 VOLTS/DIV on oscilloscope and AMPLITUDE on SC-340 in sequence and adjust each range so that the displayed amplitude is as shown in table 2-4-4-(1) (table 2-4-4-(2)).
(6) Reset SC-340 Amplitude to 30 mV.
(7) Change oscilloscope MODE to CH2 and connect the coaxial cable for CH1 to CH2 INPUT and provide a square wave.
(8) Perform the operations described in steps (5) and (6) to adjust accuracy of each range in CH2 VOLTS/DIV.

Attenuator phase adjustment

(1) Connect the probe box to CH1 INPUT of oscilloscope, attach the contact to probe head, and connect to OUTPUT 2 connector of SC-340.
(2) Connect the ground terminals of oscilloscope and SC-340 with connection cable.
(3) Set SC-340 AMPLITUDE to 0.3V.
(4) Check that the displayed amplitude is 6 div and then adjust the phase calibration variable capacitor so that the waveform is as shown in figure 2-4-4-(3) (correct compensation).
(5) Change VOLTS/DIV of CH1 to 10 mV and adjust the output voltage (AMPLITUDE) of SC-340 so that the displayed amplitude is 6 div and then adjust so that the "through phase" and "probe phase" are correctly compensated. (See Figure 2-4-4-(2).)
(6) Adjust the phase waveform for each range of CH1 VOLTS/DIV in the same manner as step (5).
(7) Reset AMPLITUDE of SC-340 to 0.3V.
(8) Change oscilloscope MODE to CH2, connect the probe used for CH1 to CH2 INPUT, and input a square wave.

Table 2-4-4-(1)

VOLTS/DIV	AMPLITUDE	Displayed amplitude
5mV	30mV	6 div
10mV	60mV	6 div
20mV	120mV	6 div
50mV	0.3V	6 div
0.1V	0.6V	6 div
0.2V	1.2V	6 div
0.5V	3V	6 div
1V	6V	6 div
2V	12V	6 div
5V	30V	6 div
10V	60V	6 div

Table 2-4-4-(2)

VOLTS/DIV	AMPLITUDE	Displayed amplitude
5mV	20mV	4 div
10mV	50mV	5 div
20mV	100mV	5 div
50mV	200mV	4 div
0.1V	0.5V	5 div
0.2V	1V	5 div
0.5V	2V	4 div
1V	5V	5 div
2V	10V	5 div
5V	20V	4 div
10V	50V	5 div
20V	100V	5 div

(9) Check that the displayed amplitude is 6 div and the wave shape is as shown in Figure 2-4-4-(3) (correct compensation). If not correctly compensated, adjust by adjusting the CH2 input variable capacitor. Note that when adjustment is performed using the input variable capacitor, the capacitance changes for all attenuator ranges. Therefore, do not change the input variable capacitor if the difference between CH1 and CH2 is not severe.
(10) Adjust the phase waveform for each range of CH2 VOLTS/DIV in the same manner as steps (5) and (6).

Figure 2-4-4-(1). Wave shape when using SQUARE WAVE 1

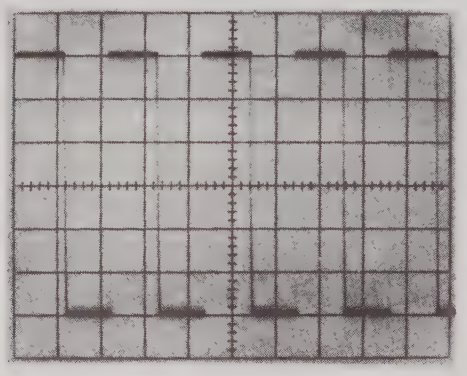


Figure 2-4-4-(2). Circuit example of attenuator

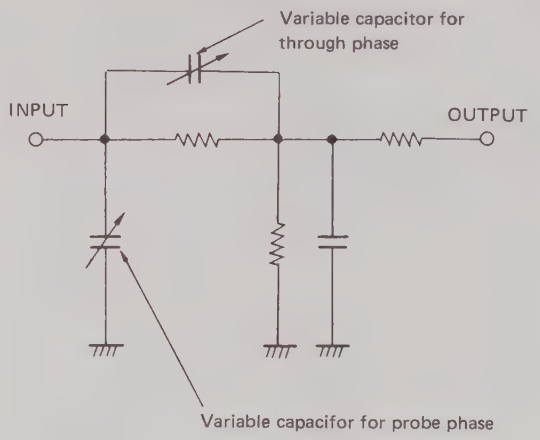
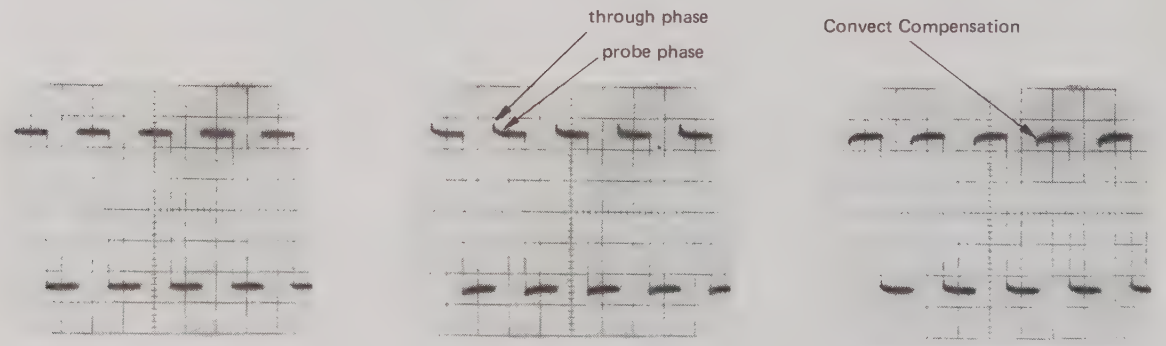


Figure 2-4-4-(3). Attenuator phase wave shape



2-4-5 Fast Rise

The following describes the calibration method of square wave characteristics at it's rise (200 ps or less).

Rise Calibration

(1) Attach a 50Ω terminator to CH1 INPUT of oscilloscope and connect it with OUTPUT 1 connector of SC-340 with a coaxial cable.

(2) Set A TIME/DIV of the oscilloscope to approximately 20 ns.

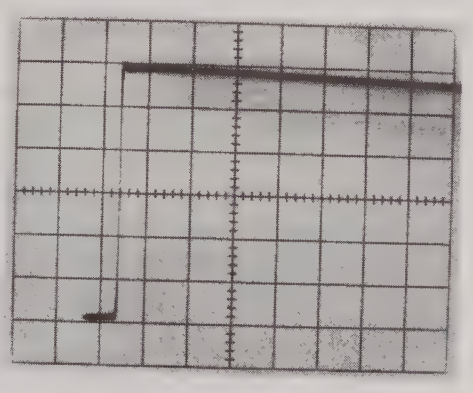
(3) Select FAST RISE on the SC-340.

(4) The operation up to now will create the wave shown in Figure 2-4-5, which is used to calibrate the rise of the square wave. Adjust so that overshoot, rounding, and ringing are at a minimum.

〈Note〉

1. When calibrating waveform using FAST RISE, oscilloscopes with frequency response up to 100 MHz can be used. Oscilloscope with response greater than 100 MHz cannot be adjusted correctly due to distortion. Waveform flatness (distortion) can be used only until 20 ns after rise except when measuring rise.
2. When adjusting overshoot, note that the waveform must be sharp and the overshoot made small in order to obtain good frequency characteristic.
3. The 3% or less distortion specification described in the "Section 1 Specifications" is a relative value obtained by comparing with Iwatsu standard tunnel pulser.

Figure 2-4-5. Wave shape when using FAST RISE



2-4-6 Square Wave 2

The following is a description of square wave adjustment method.

Square Wave Adjustment

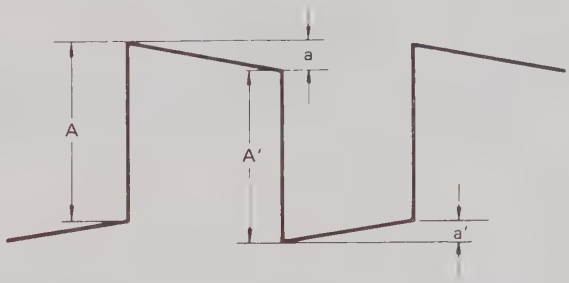
(1) Attach a 50Ω terminator to CH1 INPUT of oscilloscope and connect it to OUTPUT 3 connector of SC-340 with a coaxial cable.
(2) Set A TIME/DIV of the oscilloscope to 0.5 ms.
(3) Select SQUARE WAVE 2 on the SC-340.
(4) Check that a 1 kHz square wave is displayed.
(5) Adjust the wave to the center of the screen, adjust AMPL so that the amplitude is 4 to 6 div, sequentially switch REPETITION from 10 Hz to 100 kHz and check that there is no sag. (See Figure 2-4-6).
(6) Change MODE to CH2, connect square wave to CH2 INPUT, and check the same.
(7) Next set the A TIME/DIV of the oscilloscope to 0.1μs and REPETITION of SC-340 to 1 MHz.
(8) Display the tip of the waveform with 4 to 6 div amplitude in the center of the screen and calibrate the overshoot. (See Figures 1-3-3 and 2-4-7-(1).)
(9) Display the entire waveform and adjust ringing and rounding distortion.

〈Note〉

This instrument can be used to adjust rise for oscilloscope with frequency range up to 50MHz. This restriction does not apply when measuring the flat portion.

〈Example〉 Iwatsu SS-6050

Figure 2-4-6. Sag waveform



A: Base amplitude
a : Sag

Sag = a/A (or a'/A') x 100%
Use a/A or a'/A' whichever is greater.

2-4-7 Pulse Train

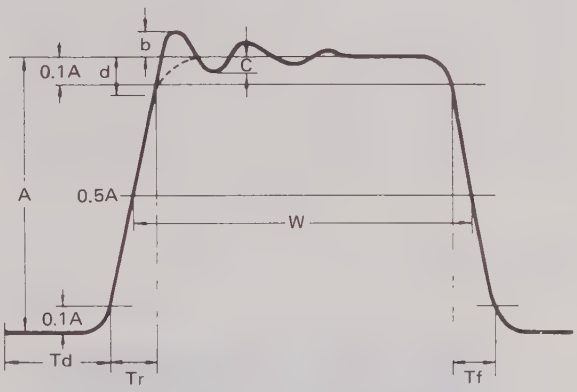
The following describes the method for calibrating the sweep time.

Sweep time adjustment

(1) Connect CH1 INPUT of oscilloscope to OUTPUT 2 connector of SC-340 with a coaxial cable.
(2) Set CH1 VOLTS/DIV of oscilloscope to 0.5V, SWEEP MODE to NORM, and A TIME/DIV to 1 ms.
(3) Select PULSE TRAIN on SC-340 and set REPETITION to 1 ms.
(4) Synchronize and adjust error [1] for 10 display divisions. (See Figure 2-4-7-(2))
(5) Calibrate error [2] between any two displayed divisions. (See Figure 2-4-7-(3).)
(6) Set REPETITION period of SC-340 to each range of A TIME/DIV of oscilloscope and adjust errors [1] and [2] in the same manner.
(7) Set HORIZ DISPLAY to DLY'D (B), B MODE to TRIG, A TIME/DIV to 2 ms, and B TIME/DIV to 1 ms.
(8) Set repetition of SC-340 to 1 ms and adjust error [1].
(9) Adjust error [2].
(10) Set REPETITION period of SC-340 to each range of B TIME/DIV and adjust.

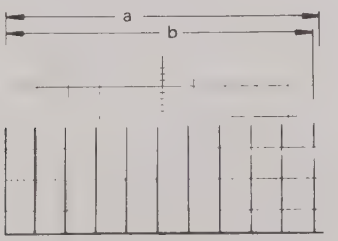
During this time, set A TIME/DIV one range slower than B TIME/DIV.

Figure 2-4-7-(1). Definition of pulse terms



A : Basic amplitude
b/A : Overshoot
c/A : Ringing
W : Pulsewidth
T : Rise time
Tf : Fall time
d/A : Rounding
Td : Signal delay time

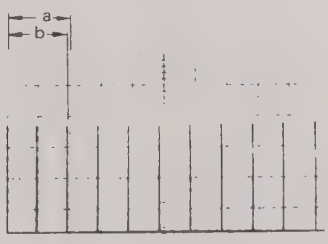
Figure 2-4-7-(2). Sweep rate error (I)



$$\text{Error rate} = \frac{a-b}{a} \times 100\ (\%)$$

where a : Horizontal effective scale (10 div)
b : Measured valve of pulse train

Figure 2-4-7-(3). Sweep rate error (II)



$$\text{Error rate} = \frac{a-b}{a} \times 100\ (\%)$$

where a : Any 2 divisions of effective scale
b : Measured value of pulse train corresponding to a.

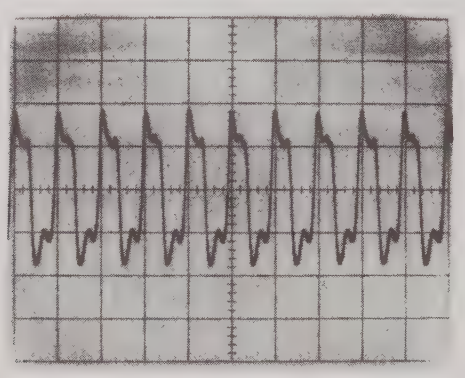
2-4-8 Pulse Train HF

Calibration method of fast sweep (10 ns and 20 ns) is described.

Adjusting fast sweep

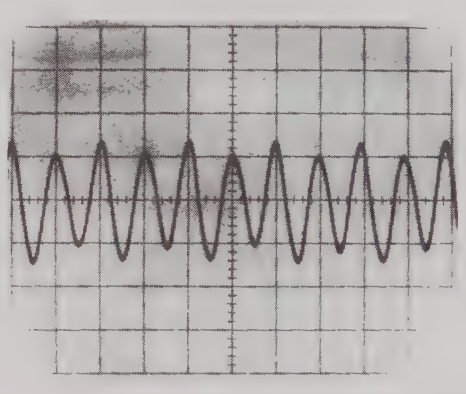
(1) Connect in the same manner as PULSE TRAIN ⊥L .
(2) Set SWEEP MODE of oscilloscope to NORM and A TIME/DIV to 20 ns.
(3) Set SC-340 waveform selection to PULSE TRAIN HF and set 10 ns/20 ns to 20 ns.
(4) Set VOLTS/DIV so that a 50 MHz square wave is displayed with an amplitude of 4 to 5 divisions and then adjust. (See Figure 2-4-8-(1).)
(5) Switch TIME/DIV of oscilloscope and repetition time of SC-340 to 10 ns, check that a sine wave with repetition frequency of 100 MHz is displayed, and then adjust. (See Figure 2-4-8-(2).)
(6) If synchronization is difficult, set as follows:
Attach a 50Ω terminator to TRIG INPUT of oscilloscope and connect it to TRIG OUT connector of SC-340 with a coaxial cable. Set TRIG SOURCE of oscilloscope to EXT.

Figure 2-4-8-(1). 20 ns output waveform



(Observed with an oscilloscope with 200 MHz (frequency response.)

Figure 2-4-8-(2). 10 ns output waveform



(Observed with 200 MHz frequency response oscilloscope)

2-4-9 Sine Wave

Calibration method of oscilloscope synchronization circuit is described.

Adjustment of synchronization

(1) Connect CH1 INPUT of oscilloscope and OUTPUT 2 connector of SC-340 with a coaxial cable.
(2) Set SWEEP MODE of oscilloscope to AUTO or NORM and A TIME/DIV to 2 ms.
(3) Set waveform selection of SC-340 to ≒ 1 kHz SINE WAVE.
(4) Set VOLTS/DIV so that the amplitude is 4 to 5 divisions (see Figure 2-4-9-(1)), set LEVEL of oscilloscope to center and triggered. Then switch SLOPE and check that + and − slopes start at the center horizontal scale line. Also, set the displayed amplitude to minimum triggering level (see section on oscilloscope specifications) and check triggering. If not synchronized, adjust the trigger circuit.
(5) Next, set the A TIME/DIV of oscilloscope to 5 ms and set waveform selection of SC-340 to LINE of SINE WAVE.
(6) Check that a line frequency sine wave is displayed with an amplitude of 4 divisions and adjust the trigger circuit. (See Figure 2-4-9-(2).)

Figure 2-4-9-(1). 1 kHz output waveform

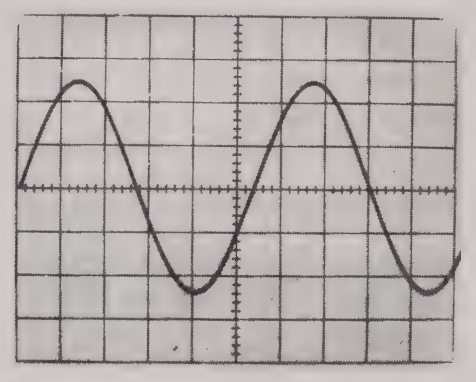
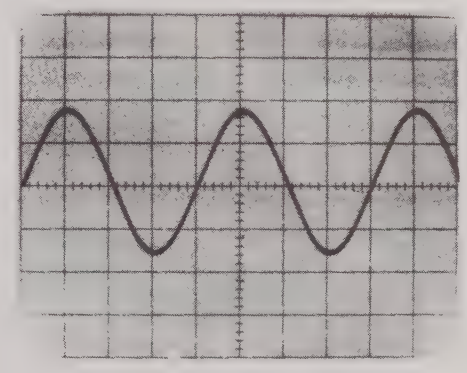


Figure 2-4-9-(2). Output waveform for LINE



Notes

Maintenance

3-1 GENERAL MAINTENANCE INFORMATION

3-1-1 Fuse Replacement

This instrument uses a slow blow fuse of 0.5A (for 100/117V AC power source) or 0.25A (for 217/234V AC power source) in the fuse holder in order to prevent damage to the circuit due to overcurrent.

If this fuse is blown, check its cause correctly, repair the defective parts or circuit, and exchange the blown fuse with the prescribed new ones. The use of a new fuse which is not prescribed may result in danger: therefore, such use is prohibited.

3-1-2 Cover Removal

The top and bottom covers can be removed by loosing four mounting screws respectively.

3-1-3 Electrode of Diode and Transistor

Table 3-1-3-(1) and 3-1-3-(2) show marking of electrode of transistors and diodes respectively.

3-1-4 Linear IC Pin Connection

Figure 3-1-4 shows pin connection of the linear ICs.

Table 3-1-3-(1) Marking for transistor electrode (bottom view)

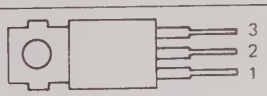
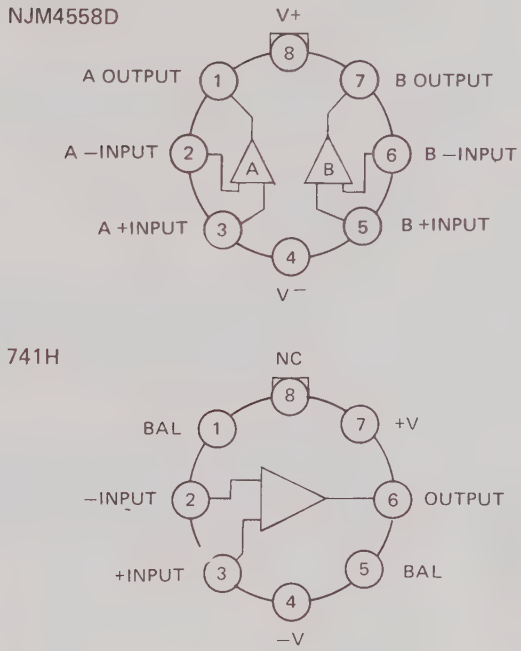
Type of transistor	Electrode marking	Type of transistor	Electrode marking
2SC154C 2SC1216	1. Emitter 2. Base 3. Collector (case)	2SA839Y 2SD288K	 Top view 1. Base 2. Collector 3. Emitter
2SC373	1. Emitter 2. Collector 3. Base		
2SC1254	1. Emitter 2. Base 3. Collector 4. Case		
2N5771	1. Emitter 2. Base 3. Collector		

Table 3-1-3-(2). Marking for diode electrode

Type of diode	Electrode marking	Polarity
1N34A 1N4756 1S953 RD type		
1S2199		
TLR104		
2B2DM 2B4DM 2B20DM		

Figure 3-1-4. Linear IC pin connection (Top view)



Section 4

Check and Adjustment

4-1 CHECK AND ADJUSTMENT

Specifications of calibrator may change with time. In order to keep this instrument operating correctly, specifications check and adjustment must be performed periodically. The recommended frequency of check and adjustment for SC-340 is once every six months.

4-2 INSTRUMENTS REQUIRED FOR CHECK AND ADJUSTMENT

The following measuring instruments and accessories are required to perform check and adjustment.

1. Digital Voltmeter

Voltage range:	0 to 1000 VDC
Accuracy	±0.05% of rdg. ±1 digit
Input impedance	Approximately 10 MΩ
Minimum range	200 mV F.S.
Resolution	10 μV 〈Example〉 Iwatsu SC-7404

2. Oscilloscope (I)

Deflection Factor	High sensitivity of 1 mV/div or more
Frequency Response	DC 100MHz 〈Example〉 Iwatsu SS-5711

3. Oscilloscope (II)

Deflection Factor	0.1V/div or more
Frequency Response	250 MHz or more
Pulse response	Calibrated
	Example: IWATSU SS-5321

4. Sampling Oscilloscope

Deflection Factor	50 mV/div or more
Frequency Response	3.5 GHz or more
Pulse response	Calibrated
	Example: IWATSU SAS-601B.

5. Frequency counter

Frequency range	500 Hz to 100 MHz 〈Example〉 Iwatsu SC-7101

6. Frequency Counter

Frequency range	500 Hz to 100 MHz Example: IWATSU SC-7101

7. Passive probe

Attenuation rate	1:1 〈Example〉 Iwatsu SS-0001/SS-0002/SS-0003

8. 6 dB Attenuator — Example: IWATSU AA-06B
9. Resistor

Resistance	1 MΩ, 1/4W
Accuracy	Within ± 0.5% (accuracy of ± 0.05% is desiable for accurate adjustment.)

4-3 CHECK AND ADJUSTMENT PRECAUTIONS

Take the following precautions when performing check and adjustment:

(1) SC-340 is an oscilloscope (a measuring instrument) calibrator. Use high precision measuring instruments to adjust this instrument. Careless selection of measuring instrument can degrade the specification of this instrument.

(2) DC voltage from the secondary is supplied to every circuit and if its voltage or ripple changes beyond specification, the specification of this instrument is affected. Therefore, check this voltage even when performing partial check and adjustment.

(3) Check and adjustment secondary DC voltage, square wave 1, pulse train, and sine wave.

4-4 CHECK AND ADJUSTMENT

4-4-1 Check Secondary DC Power Supply Voltage

Rating

Each output voltage and ripple voltage must be within the values shown in table 4-4-1.

Table 4-4-1

Median Voltage	Voltage Range	Ripple Voltage	Adjustment Location	Measurement Location
+100V	+99.5 to +100.5V	0.1 Vp-p or less	R202	TP231
+ 12V	+11.4 to 12.6V	0.1 Vp-p or less	–	Q206·E
+ 5V	+4.75 to +5.25V	50 mVp-p or less	–	Q210·E

E : Emitter

〈Preparing for check〉

Set ⊓ ⊓ switch to ⊓ .

〈Check〉

(1) Measure the voltages between the measurement locations (see Figure 4-4-1) shown in table 4-4-1 and ground and check that they are within ranges shown in table 4-4-1.

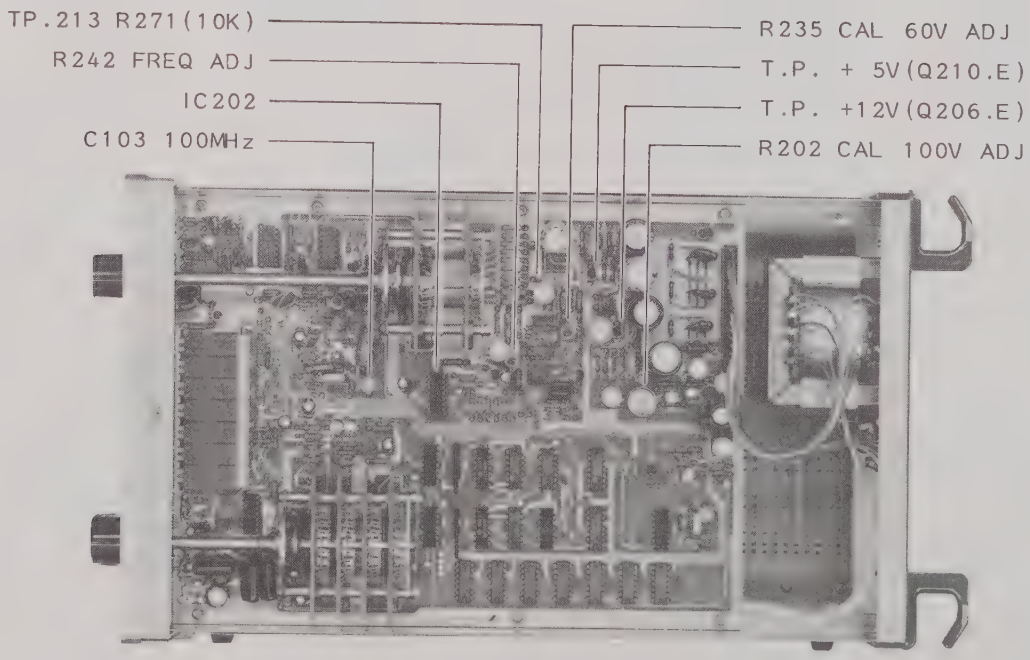
(2) Measure the ripple voltage of each power source with testing oscilloscope and check that is is within the value specified in table 4-4-1. Be sure to set the deflection factor of the testing oscilloscope to 50 mV/div or more and use a passive probe with attenuation ratio of 1:1.

〈Note〉

Adjustment method is the same as for CAL100V ADJ asjustment described in section "4-4-2 Square Wave 1 Check and Adjustment." Perform check only at this point.

If it is determined that the output voltage error is great, perform 4-4-2 Square Wave 1 Check and Adjustment and then re-adjust. (When +100V power is adjusted, +12V and +5V power will fall within rating without adjustment.)

Figure 4-4-1. Top view



4-4-2 Square Wave 1 Check and Adjustment

〈**Rating**〉

Each output voltage must be within the range shown in table 4-4-2. Other values must also be within ± 0.5%.

Table 4-4-2

AMPLITUDE	⊓ ⊓	Voltage Range	Adjustment Location	Measurement Location
100V	⊓	99.5 to 100.5V	R202	OUTPUT 2
60V	⊓	59.7 to 60.3V	R235	OUTPUT 2

〈**Check and adjustment preparation**〉

Perform the following before check and adjustment.

(1) Set wave selection switch to SQUARE WAVE 1.
(2) Connect a 1 MΩ load to output connector OUTPUT 2.
(3) Remove IC202 from socket. (See Figure 4-4-1.)

〈**Check and adjustment**〉

(1) After making the above setting, measure the voltage between the measurement location and ground with a digital voltage meter and check that it is within range shown in table 4-4-2.
(2) If it is out of rating, adjust with R202 CAL 100V ADJ and R235 CAL 60V ADJ (See Figure 4-4-1.)
(3) Then measure the voltage of each range from 100V to 100 mV and 60V to 60 mV with a digital voltage meter and check that it is within rating (±0.5%). If any one is out of rating, adjust with R202 and R235 until all values are within rating.
(4) Turn off the SC-340 power, remove the 1 MΩ resistor described in 〈Check and adjustment Preparation〉 section items (2) and (3), insert IC202 in the socket, and then turn on the power. (See Figure 4-4-3.)
(5) Use high deflection factor oscilloscope to check output voltage between 50 mV and 0.2 mV, and 30 mV and 0.12 mV. (The range below 50mV uses the same circuit (divided 1000:1 by a resistor) as the range above 120 mV. Therefore, measurement with digital voltage meter is not necessary because it is the same as item (3).)

〈**Check**〉

Measure the waveform distortion and duty ratio in each range with an oscilloscope and check that they are within the following ratings:

Distortion	overshoot (rounding)	within 10%
	sag	within 0.5%
Duty ratio	within 40:60	

4-4-3 Pulse Train Check and Adjustment

〈**Rating**〉

HF and repetition rate of ⊥⊥ must be within rating shown in table 4-4-3-(1).

The range below 0.1 μs for ⊥⊥ must also be within ±0.05%.

Table 4-4-3-(1)

Location	Range	Repetition Rate Range	Adjustment Location	Measurement Location
HF	10 ns	99.95 to 100.05 MHz	C103	OUTPUT 2
HF	20 ns	49.975 to 50.025 MHz	—	OUTPUT 2
⊥⊥	0.1 ns	9.995 to 10.005 MHz	C 10	OUTPUT 2

〈**Check and adjustment preparation**〉

(1) Set waveform selection switch to PULSE TRAIN HF.
(2) Set 10 ns/20 ns switch to 10 ns.
(3) Set repetition to 0.1 μs.

Figure 4-4-3. Direction of IC

Check the pin numbers of the IC and socket.

〈**Check and adjustment**〉

(1) Measure the repetition rate output to measurement location (OUTPUT 2) with a frequency counter and check that it is within rating.
(2) If it is out of rating, adjust with C103 (see Figure 4-4-1.)
(3) Switch 10 ns/20 ns switch to 20 ns and perform the same check.
(4) Set waveform selection switch to PULSE TRAIN ⊥⊥ and perform the same check.
(5) If it is out of rating, adjust with C10.
(6) Sequentially change repetition from 0.1 μs to 2 s, measure each range, and check that the value is within rating (±0.05%).

〈**Check**〉

Use an oscilloscope to check that the output waveform and voltage are as shown in table 4-4-3-(2).

Table 4-4-3-(2)

Location	Output Waveform	Output Voltage
HF	Sine and square wave	0.2V or more (at 50Ω load)
⊥⊥	Differential wave	0.1V or more (at 50Ω load)

〈**Note**〉

Use an oscilloscope with frequency response from DC to 100 MHz for measuring waveform for HF.

4-4-4 SINE WAVE Check and Adjustment

〈Rating〉

Repetition rate 1 kHz ± 20% and line output voltage 0.2 Vp-p or more.

〈Check and adjustment〉

(1) Set waveform selection switch to sine wave ≒ 1 KHz.
(2) Measure the repetition frequency output to OUTPUT 2 with a frequency counter and check that it is within rating.
(3) If it is out of rating, adjust with R242 FREQ ADJ (see Figure 4-4-1).
(4) Measure the output voltage at OUTPUT 2 with an oscilloscope and check that it is 0.2 Vp-p or more.
(5) Switch waveform selection switch to LINE.
(6) Measure the repetition frequency output to OUTPUT 2 with a frequency counter and check that it is the same as the primary power voltage frequency.
(7) Measure the output voltage at OUTPUT 2 with an oscilloscope and check that it is 0.2 Vp-p or more.

4-4-5 TRIG OUT Check

〈Rating〉

Refer to table 1 in "Section 1 Specifications".

〈Check〉

(1) Switch the waveform selection switch and for each waveform, check with oscilloscope the trigger signal from TRIG OUT, output voltage, and time difference with OUTPUT 1 and OUTPUT 2 signals, according to table 1-3-7.
(2) Measure the repetition rate of signal output from TRIG OUT with a frequency counter and check that it is as shown in table 1-3-7.

Notes

Section 5

Electrical Parts List

5-1 GENERAL

5-5-1 Ordering Information

Replacement parts may be ordered through an IWATSU Representative or directly from the factory. To be certain of receiving the proper parts, a ways include the following information with the order:

a. Model Number and serial number of the instrument on which the parts will be installed.
b. Circuit reference number and subassembly name, if applicable, for which the part is intended. If the part does not have a circuit reference, the description from the parts list should be used.
c. Iwatsu part number.

For factory repair, contact the IWATSU agent and include the following information.

a. Model number and serial number of the instrument on which the work is to be performed.
b. Details concerning the nature of the malfunction, or, type of repair desired.
Shipping instructions will be sent to you promptly.

5-5-2 How to use This Parts List

The parts list is divided into subsections corresponding to the schematic diagrams such as "PULSE TRAIN & SQUARE WAVE 2", "MODE SWITCHING, PULSE TRAIN (HF) & FAST RISE", and "SINE WAVE, SQUARE WAVE 1 & POWER SUPPLY". Component locations can be determined from the schematic diagrams, each component appears only once in the parts list. At the beginning of each subsection are listed part numbers for any complete subassemblies in that category that are available as replacement parts. These subassemblies may include individually-listed components; care should be taken to locate malfunctions to the lowest possible level of replacement part and thus avoid the time and cost involved in "over-repair".

5-5-3 Abbreviations

Cap ..... Capacitor
cer. ..... ceramic
Poly. ..... Polyethytel film
elect. ..... aluminium electrolytic chemical
elect. tan··· tan-talum electrolytic chemical condenser
[The symbol of F (farad) is omitted]
Res. ..... Resistor
w.w. ..... wire wound
comp. ..... composition
[The symbol of Ω (ohm) is omitted]
FET ..... Field Effect Transistor
Diode
Z. diode ··· Zenner diode
Var. ..... variable

5-2 PARTS LIST

5-2-1 PULSE TRAIN & SQUARE WAVE 2

CKT. NO.	DESCRIPTION	IWATSU PART NO.
C 1	Cap., 0.01μ, +80.20%, 50V, Cer.	740600580
C 2	Same as C1	
C 3	Same as C1	
C 4	Same as C1	
C 5	Same as C1	
C 6	Cap., 330p, ±5%, 50V, Cer.	740506791
C 8	Same as C6	
C 9	Cap., 43, ±5%, 50V, Cer.	740506230
C10	Cap., 20p, Var., 500V, Cer.	741100870
C11	Same as C1	
C12	Cap., 1000p, +80 −20%, 50V, Cer.	740601750
C13	Cap., 15p, ±5%, 50V, Cer.	740506610
C14	Cap., 0.1μ, ±20%, 100V, Poly.	741304600
C16	Cap., 20p, ±5%, 50V, Cer.	740505280
C17	Cap., 150p, ±10%, 50V, Cer.	740503010
C19	Cap., 1μ, +150 −10%, 50V, Elect.	741200970
C20	Cap., 0.1μ, ±10%, 50V, Poly.	741302470
C21	Same as C20	
C22	Cap., 0.022μ, ±10%, 50V, Poly.	741305354
C23	Cap., 0.01μ, ±10%, 50V, Poly.	741302430
C24	Cap., 2200p, ±10%, 50V, Poly.	741305356
C26	Cap., 470p, +5%, 50V, Cer,	740502430
C27	Cap., 91, ±5%, 50V, Cer.	740506270
C29	Cap., 68p, ±5%, 50V, Cer.	740503390
C30	Cap., 47p, ±5%, 50V, Cer.	740502730
C31	Cap., 100μ, +100 −10%, 16V, Elect.	741203020
C32	Same as C14	
C36	Same as C 1	
C37	Cap., 4.7μ, +100 −10%, 35V, Elect.	741205100
C39	Cap., 33μ, +100 −10%, 16V, Elect.	741206612
C40	Same as C39	
C41	Cap., 82p, ±5%, 50V, Cer.	740506759
C42	Same as C41	
C50	Cap., 2p, ±0.25%, 50V, Cer.	740501690
C51	Same as C50	
C55	Same as C14	
R 1	Res., 4.7k, ±5%, ¼W, Carbon	742232040
R 2	Res., 12, ±5, ¼W, Carbon	742234470
R 3	Res., 3k, ±5, ¼W, Carbon	742231990
R 4	Res., 200, ±5, ¼W, Carbon	742233840
R 6	Res., 15k, ±5, ¼W, Carbon	742231930
R 7	Res., 360, ±2, ½W, Carbon	742410330
R 9	Res., 360, ±5, ¼W, Carbon	742232480
R10	Same as R4	
R11	Res., 390, ±5%, ¼W, Carbon	742232500
R12	Same as R6	
R13	Res., 620, ±5%, ¼W, Carbon	742232540
R14	Res., 16k, ±5%, ¼W, Carbon	742233450
R15	Res., 680, ±5%, ¼W, Carbon	742232550
R16	Res., 18k, ±5%, ¼W, Carbon	742232690
R17	Res., 470, ±5%, ¼W, Carbon	742232630
R18	Same as R6	
R19	Res., 7.5k, ±5%, ¼W, Carbon	742232100
R20	Res., 150, ±5%, ¼W, Carbon	742233280
R21	Res., 3.9k, ±5%, ¼W, Carbon	742232020
R22	Same as R20	
R23	Res., 750, ±5%, ¼W, Carbon	742232570
R24	Same as R4	
R26	Res., 200, Var., 0.125W, Carbon	743220050
R27	Same as R20	
R28	Res., 3k, Var., 0.5W, Metal	743493144
R29	Res., 1k, ±5%, ¼W, Metal	742300030
R30	Res., 130, ±2%, ¼W, Metal	742216480
R31	Res., 51, ±2%, ¼W, Metal	742215610
R32	Res., 240, ±2%, ¼W, Metal	742214550

CKT. NO.	DESCRIPTION	IWATSU PART NO.
R33	Res., 75, ± 2%, ¼W, Metal	742215980
R34	Res., 39, ± 2%, ¼W, Metal	742216520
R36	Res., 2.2k, ±5%, ¼W, Carbon	742231960
R37	Same as R4	
R39	Same as R4	
R40	Same as R2	
R41	Same as R2	
R43	Res., 100, ±5%, ¼W, Carbon	742233190
R44	Res., 51, ±5%, ¼W, Carbon	742234010
R50	Resistor Array, RM-8-47kΩk	744703829
R51	Same as R50	
R53	Res., 1.5k, ± 2%, ½W, Metal	742213880
R60	Res., 1k, ±5%, ¼W, Carbon	742231900
D 1	Diode, RD5EB	740405330
D 2	Diode, HZ7⊕B2	740405407
D 3	Diode, 1N34A	740400700
D 4	Same as D3	
D 5	Same as D3	
Q 1	Transistor, 2SC1216	740306170
Q 2	Transistor, 2N5771	740306760
Q 3	Same as Q2	
Q 4	Same as Q2	
Q 5	Same as Q1	
Q 6	Same as Q1	

CKT. NO.	DESCRIPTION	IWATSU PART NO.
IC 1	Integrated circuit, SN7490	740307090
IC 2	Same as IC1	
IC 3	Same as IC1	
IC 4	Same as IC1	
IC 5	Same as IC1	
IC 6	Same as IC1	
IC 7	Same as IC1	
IC 8	Integrated circuit, SN7400	740307220
IC 9	Integrated circuit, SN7404	740307190
IC10	Same as IC9	
IC11	Integrated circuit, SN7454	740307100
IC12	Same as IC11	
IC13	Same as IC11	
IC14	Same as IC1	
IC15	Same as IC1	
IC16	Same as IC8	
IC17	Same as IC8	
IC18	Same as IC8	
IC21	Same as IC8	
S1	Rotary Switch, PS43P(24)-4-4-23	744317052
S2	Push Switch, KSD1-2-0LLDC	744301548
X1	Crystal, HC-18/V 10MHZ	744501720
J1	BNC Connector	744703952

5-2-2 Mode Switching, PULSE TRAIN (HF) & FASTRISE

CKT.NO.	DESCRIPTION	IWATSU PART NO.
C103	Cap., 3.5～10p, Var., 500V, Cer.	741100820
C106	Cap., 0.01μ, ±10%, 50V, Cer.	740600580
C108	Cap., 120p, ± 5 %, 50V, Cer.	740504970
C110	Cap., 15p, ±10%, 500V, Cer.	740501960
C112	Cap., 33p, ±10%, 500V, Cer.	740502500
C113	Same as C108	
C115	Cap., 6p, ±0.5%, 500V, Cer.	740503670
C116	Same as C106	
C121	Cap., 1000p, ±10%, 50V, Cer.	740601750
C122	Same as C106	
C123	Same as C108	
C124	Same as C106	
C125	Same as C110	
C130	Same as C106	
C131	Cap., 10μ, +100 −10%, 16V, Elect.	741203110
C136	Same as C106	
C152	Same as C106	
C153	Cap., 0.1μ, ±10%, 50V, Poly.	741302470
C158	Same as C106	
C160	Same as C106	
L101	Inductor, Coil	744005798
L102	Pulse Transformer	744005797
L152	Inductor, Coil	744005817
R100	Res., 390, ±2%, ¼W, Metal	742213790
R102	Res., 270, ±5%, ¼W, Carbon	742232700
R105	Same as R102	
R108	Res., 200, ±5%, ¼W, Carbon	742233840
R110	Res., 10k, ±5%, ¼W, Carbon	742232130
R111	Res., 1k, ±5%, ¼W, Carbon	742231900
R112	Same as R110	
R113	Res., 270, ±2%, ½W, Carbon	742410300
R114	Res., 2k, Var., 0.5W, Metal	743493145
R115	Res., 51, ±5%, ¼W, Carbon	742234010
R116	Same as R108	
R117	Res., 75, ±5%, ¼W, Carbon	742233990
R118	Res., 2k, ±5%, ¼W, Carbon	742231950
R120	Res., 56, ±5%, ¼W, Carbon	742234380
R121	Same as R108	
R122	Same as R120	
R123	Res., 680, ±5%, ¼W, Carbon	742232550
R124	Same as R123	
R126	Same as R123	
R128	Same as R118	
R130	Same as R123	
R131	Same as R123	
R132	Res., 150, ±5%, ¼W, Carbon	742233280
R133	Same as R120	
R136	Res., 47k, ±5%, ¼W, Carbon	742232240
R138	Res., 62k, ±5%, ¼W, Carbon	742232080
R140	Res., 3k, ±5%, ¼W, Carbon	742231990
R141	Res., 270, ±2%, ½W, Carbon	742410300
R142	Same as R138	
R143	Same as R140	
R146	Same as R108	
R148	Res., 20, ±5%, ¼W, Carbon	742234490
R150	Res., 200, Var., 0.5W, Metal	743493139
R152	Res., 240, ±5%, ¼W, Carbon	742234020
R153	Same as R138	
R156	Res., 4.7k, ±5%, ¼W, Carbon	742232040
R158	Same as R111	
R159	Res., 12, ±5%, ¼W, Carbon	742234470
R160	Res., 50, ±2%, ½W, Carbon	742730310
R161	Same as R160	
R162	Same as R160	
R163	Same as R160	
R180	Res., 300, ±5%, ¼W, Carbon	742234340
R182	Same as R111	
R185	Same as R102	

CKT.NO.	DESCRIPTION	IWATSU PART NO.
R191	Same as R156	
R192	Same as R110	
R193	Res., 390, ±5%, ¼W, Carbon	742232500
R194	Same as R110	
R195	Same as R110	
R196	Same as R115	
D102	Diode, 1S953	740401720
D109	Diode, RD5A	740400770
D110	Same as D102	
D111	Same as D102	
D112	Same as D102	
D113	Same as D102	
D160	T.Diode, 1S2199	740404480
Q100	Transistor, 2N5771	740306760
Q101	Transistor, 2SC1254	740306860
Q102	Same as Q100	
Q103	Same as Q100	
Q106	Same as Q100	
Q108	Same as Q100	
Q130	Same as Q100	
Q132	Same as Q100	
Q138	Same as Q100	
Q146	Same as Q100	
Q158	Same as Q101	
IC103	Integrated circuit, MC10231L	740308257
IC104	Integrated circuit, 93S10DC	740308488
S100	Push Switch, KSD7-28-10IL-DC	744301715
S101	Slide Switch, SLBP222C	744300600
X101	Crystal, HC18/U-100MHZ	744501780
J101	BNC Connector, BNC-BR-226	745002530
J102	Same as J101	
J103	BNC Connector, P/N31-010	745006381

5-2-3 SINE WAVE, SQUARE WAVE 1 & Power Supply

CKT.NO.	DESCRIPTION	IWATSU PART NO.
C201	Cap., 0.47μ, +100−10%, 100V, Elect.	741206764
C202	Cap., 22μ, +100−10%, 160V, Elect.	741206631
C203	Cap., 47μ, +100− 10%, 160V, Elect.	741206682
C204	Cap., 470μ, +100−10%, 35V, Elect.	741203650
C205	Cap., 1000μ, +100−10%, 25V, Elect.	741200120
C206	Same as C205	
C207	Cap., 470μ, +100−10%, 10V, Elect.	741203190
C208	Cap., 0.01μ, +100−0%, 500V, Cer.	740600730
C209	Cap., 47μ, +100 −10%, 16V, Elect.	741206759
C210	Cap., 0.01μ, +80−20%, 50V, Cer.	740600580
C211	Cap., 10μ, +100−10%, 16V, Elect.	741203110
C212	Same as C211	
C213	Cap., 820p, ±5%, 300V, Mica	740905798
C214	Same as C213	
C215	Same as C213	
C220	Cap., 470p, ±10%, 50V, Cer.	740502430
C221	Cap., 47p, ±10%, 50V, Cer.	740502730
C222	Same as C210	
C226	Cap., 12p, ±10%, 500V, Cer.	740501950
C291	Cap., 680p, ±10%, 500V, Cer.	740603287
R200	Res., 33, ±2%, ¼W, Metal	742215750
R201	Res., 91k, ±2%, ¼W, Metal	742216070
R202	Res., 500, Var., 0.5W, W.W.	742310360
R203	Res., 8.2k, ± 2%, ¼W, Metal	742214670
R204	Res., 390, ± 2%, ¼W, Metal	742213790
R205	Res., 220, ± 5%, ¼W, Carbon	742232470
R206	Res., 270k, ±2%, ¼W, Metal	742219058
R207	Res., 200k, ±2%, ¼W, Metal	742214070
R210	Res., 51k, ± 2%, ½W, Metal	742218970
R211	Res., 30k, ± 2%, ¼W, Metal	742214050
R212	Res., 1.0, ± 5%, 1W, Metal	742219301
R213	Res., 120k, ±2%, ¼W, Metal	742215820
R214	Res., 6.2k, ±2%, ¼W, Metal	742214150
R216	Res., 5.1 k, ±2%, ¼W, Metal	742213960
R217	Res., 3.6 k, ±2%, ¼W, Metal	742213930
R219	Same as R211	
R220	Res., 0.62, ±5%, 1W, Metal	742219353
R221	Same as R213	
R222	Same as R214	
R223	Res., 30k, ±5%, ¼W, Carbon	742232210
R224	Res., 51k, ±5%, ¼W, Carbon	742232250
R225	Same as R205	
R226	Res., 6.2 k, ± 5%, ¼W, Carbon	742232080
R230	Same as R207	
R231	Res., 8.2 k, ±2%, ½W, Metal	742219337
R232	Res., 13 k, ±2%, ½W, Metal	742219237
R233	Res., 510, ±5%, ¼W, Carbon	742232520
R234	Res., 1k, ±5%, ¼W, Carbon	742231900
R235	Res., 2k, Var., 0.5W, Metal	743493145
R236	Res., 15k, ±5%, ¼W, Carbon	742232680
R237	Res., 10k, ±5%, ¼W, Carbon	742232130
R238	Same as R237	
R240	Same as R236	
R241	Same as R207	
R242	Res., 20k, Var., 0.5W, Metal	743493141
R243	Same as R207	
R244	Same as R207	
R246	Res., 1.2 k, ± 5%, ¼W, Carbon	742232610
R247	Res., 750, ± 5%, ¼W, Carbon	742232570
R249	Res., 51, ± 5%, ¼W, Carbon	742234060
R250	Res., 1.5k, ±2%, ¼W, Metal	742213880
R261	Res., 3k, ± 5%, ¼W, Carbon	742231990
R262	Same as R261	
R264	Same as R233	
R270	Res., 50k, ± 0.25%, ½W, Metal	742219349
R271	Res., 10k, ± 0.25%, ½W, Metal	742219348
R272	Res., 6.67k, ±0.25%, ¼W, Metal	742219347
R273	Res., 1.79k, ±0.25%, ¼W, Metal	742219346
R274	Res., 801, ±0.25%, ¼W, Metal	742219345

CKT.NO.	DESCRIPTION	IWATSU PART NO.
R276	Res., 452, ±0.25%, ¼W, Metal	742219344
R277	Res., 146.1, ±0.25%, ¼W, Metal	742219343
R279	Res., 72.4, ±0.25%, ¼W, Metal	742219342
R280	Res., 43.1, ±0.25%, ¼W, Metal	742219341
R281	Res., 28.6, ±0.25%, ¼W, Metal	742219340
R283	Res., 21.4, ±0.25%, ¼W, Metal	742219339
R284	Res., 1k, ±2%, ½W, Metal	742219338
R286	Same as R270	
R287	Res., 50, ±0.25%, ¼W, Metal	742219070
R289	Same as R233	
R290	Res., 3k, ±5%, ¼W, Carbon	742231990
R291	Same as R223	
R292	Res., 66.82k, ±0.25%, ½W, Metal	742219350
R293	Same as R281	
D201	Z.Diode, 1N4756	740405249
D202	Same as D201	
D203	Diode, 1S953	740401720
D204	Diode, 1S2191	740404510
D206	Same as D203	
D207	Same as D203	
D209	Z.Diode, RD6.2E	740405306
D210	Diode Stack, 2B20DM	740405300
D211	Diode Stack, 2B4DM	740405218
D212	Diode Stack, 2B2DM	740405239
D215	L.E.Diode, TLR104	740405229
D232	Same as D203	
D233	Same as D203	
Q200	Transistor, 2SC154C	740304000
Q201	Same as Q200	
Q203	Same as Q200	
Q204	Transistor, 2SD288K	740308478
Q206	Transistor, 2SC373(G)Y	740304110
Q207	Same as Q204	
Q209	Same as Q206	
Q210	Same as Q206	
Q211	Same as Q200	
Q212	Transistor, 2SA839Y	740308489
Q213	Same as Q200	
Q214	Same as Q206	
Q261	Same as Q206	
IC200	Integrated circuit, 741H	740308164
IC201	Integrated circuit, NJM4558D	740308136
IC202	Integrated circuit, SN7400	740307220
IC203	Same as IC201	
U201	Power Cord, P6A-3V(3m)	744701710
F200	Fuse (Slow Blow), FSA-0.5	745400310
S200	Toggle Switch, MTA206N	744301639
S201	Rotary Switch, PS43P(24)-2-2-18KS	744317053
S202	Push Switch, KSD1-2-OLLDC	744301548
T201	Power Transformer	744713060
TB201	Ground Terminal, 8φ	745100320
J201	Connector, 128-15-10-281	745006327
P201	Same as J201	

Notes

Schematic Diagrams

PB102

REPETITION

SO1

SQUARE WAVE 2 OUTPUT 3

SO2

TO S100 G3-2

TO S100 G1 ③

TO S100 C2 ③

TO S100 C3 ③

TO R100

TO R105

TO S100 ③

PERIOD | FREQ

SEC | Hz | mSEC | KHz | μSEC | MHz

SC-340
PULSE TRAIN &
SQUARE WAVE 2 CIRCUIT

K-606443 | 1

PB102

OUTPUT 2
J101

TRIG OUT
J102

S101
20nS
10nS

S100

MODE

+5V
FAST RISE
A1

A3

A2

A4
FROM R159

+12V
SQUARE WAVE 1
B1
D110 1S953
R180 300
FROM C210
R182 1K

B3
Q
J
FROM R287

B2

B4

PULSE TRAIN
HF
C1
R100 390
FROM IC21 (5)
D111 1S953
R102 270

C3
FROM R40

C2

C4
FROM R41

D1

D3

D2
FROM R146

D4

~ ≒ 1KHz
SINE WAVE
~ LINE
E1
D112 1S953
FROM R246

E3
FROM R247

E2

E4

R105 270
F1
FROM IC08 (14)
D109 RD5A

F3
FROM R250
C160 0.01µ

F2

F4

SQUARE WAVE 2
G1
D113 1S953
FROM R07

G3
FROM R51

G2

G4
FROM R02

S100

A1 A2	A3 A4
B1 B2	B3 B4
C1 C2	C3 C4
D1 D2	D3 D4
E1 E2	E3 E4
F1 F2	F3 F4
G1 G2	G3 G4

R191 4.7K
C106 0.01µ
R192 10K
Q100 2N5771
X101 (100MHz)
L101
C115 6
R193 390
C130 0.01µ
C131 10µ 16V
R194 10K
C103 10
C110 15
C112 33

L102
R195 10K
C116 0.01µ
R196 31
Q102 2N5771
Q103 2N5771
+12V
R113 270 (½W)
+5V
D102 1S953
LEVEL ADJ.
R114 2K
R117 75
C123 120
C113 120
R116 200
R118 2K
+12V
R110 10K
R115 51
R112 10K
C108 120
R108 200
Q101 2SC 1254
R111 1K
J

+5V
R126 680
R128 2K
C121 1000

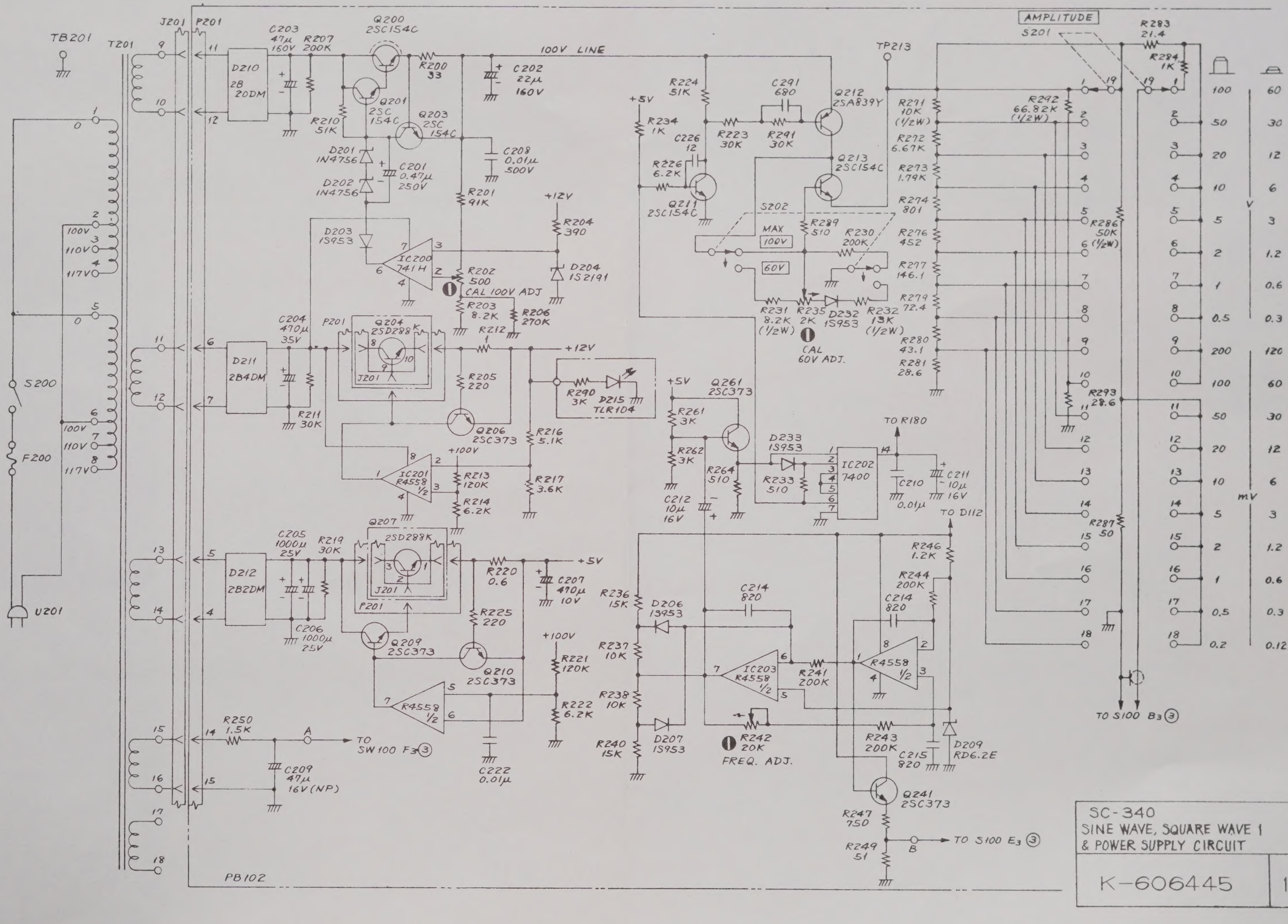
+5V
C122 0.01µ
R120 56
R122
e

Q106 2N5771
Q108 2N5771
C125 15
R121 200
R123 680
R124 680
IC 103 MC 10231
+5V
R131 680
Q130 2N5771
R130 680
+5V
R133 56
Q132 2N5771
R132 150
IC104 93510 DC
+5V
C124 0.01µ
R138 6.2K
+12V
Q138 2N5771
R141 270 (½W)
+12V
R142 6.2K
Q146 2N5771
R143 3K
C136 47K
C136 0.01µ
R140 3K
R146 200
Z
TO S100 D2 (3)

R185 270
R150 200
R148 20
C153 0.1µ
L152
D
E
OUTPUT 1
J103
R161 50
R160 50
R162 50
R163 50
D160 1S 2199
PB101
F
G
R152 240
+12V
R153 6.2K
Q158 2SC1254
C152 0.01µ
C158 0.01µ
R156 4.7K
R158 1K
R159 12
H
TO S100 A2 (3)

SC-340
MODE SWITCHING PULSE TRAIN(HF) & FAST RISE CIRCUIT

K-606444 | 1



SC-340
SINE WAVE, SQUARE WAVE & POWER SUPPLY CIRCUIT

K-606445 | 1

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